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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JOSEPH W. HARRIS

Appeal 2009-011888
Application 10/628,651
Technology Center 1700

Before BRADLEY R. GARRIS, CHARLES F. WARREN, and MARK NAGUMO, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

Applicant appeals to the Board from the decision of the Primary Examiner finally rejecting claims 1, 5-7, 22, 25, and 35-44 in the Office Action mailed April 8, 2008. 35 U.S.C. §§ 6 and 134(a) (2002); 37 C.F.R. § 41.31(a) (2008).

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[1] The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, or for filing a request for rehearing, as recited in 37 C.F.R. § 41.52, begins to run from the "MAIL DATE" (paper delivery mode) or the "NOTIFICATION DATE" (electronic delivery mode) shown on the PTOL-90A cover letter attached to this decision.

An oral hearing was held May 4, 2010.

We affirm the decision of the Primary Examiner.

Claim 1 illustrates Appellant's invention of a solid brazing component, and is representative of the claims on appeal:

1. A solid brazing component having a liquidus temperature above 840°F selected from the group consisting of wire, strip, foil and preforms, wherein the brazening component is made of an alloy consisting essentially of, in weight percent:

(a) about 4-9% phosphorus;

(b) about 0.1-10% tin;

(c) about 0.1-15% nickel;

(d) about 0.1-18% silver;

(e) up to about 3% silicon;

(f) up to about 4% antimony;

(g) up to about 3% manganese; and

the balance copper.

Appellant requests review of the following grounds of rejection under 35 U.S.C. § 103(a) advanced on appeal by the Examiner (App. Br. 5-6):

Claims 1, 5-7, 22, 25, and 35-44 over the abstract of PL 149319 B1 to Bziawa prepared by Chemical Abstracts Service (AN 1991:455033)[2]

[2] The Examiner relies on a commercially prepared abstract for each of the foreign patent documents cited in the grounds of rejection. Ans. 4, 7, and 8. Each commercial abstract is in fact a separate and distinct document from the foreign patent document. Appellants do not dispute the Examiner's reliance on the commercial abstracts as prior art. *See generally* Briefs. Accordingly, we have considered the commercial abstracts for the information each conveys to one of ordinary skill in the art. Indeed, the Examiner does not rely on, and we have not considered, the translations of the foreign patent documents mailed with the Examiner's Answer. *See generally Ans.*

(Bziawa abstract) in view of the abstract of CN 1060052A to Feng prepared by Chemical Abstracts Service (AN 1992:618043) (Feng abstract) (Ans. 4);[3]

Claims 39-42 over the Bziawa abstract as applied to claims 1, 5-7, 22, 25, and 35-44, further in view of Yurasko or Joseph (Ans. 6);

Claims 35-42 over the abstract of EP 0 465 861 A1 to Lugscheide prepared by Derwent Patent Abstracts (An 1992-017537) (Lugscheide abstract) in view of the Feng abstract (Ans. 7);

Claims 22 and 25 over the abstract of SU 1706816 A1 to Smirnov prepared by Chemical Abstracts Service (AN 1993:43876) (Smirnov abstract) in view of the Feng abstract (Ans. 7);[4]

Claims 22, 25, 35-42, and 44 over Yurasko in view of the Feng abstract (Ans. 7);

Claims 22, 25, 35-38, and 44 over the Feng abstract (Ans. 8); and

Claims 1, 5, 22, and 43 over Joseph (Ans. 8).

We decide this appeal based on independent claims 1, 22, 35, and 39, at least one of which appears in each of the grounds of rejection, and on the dependent claims as argued under headings in the Appeal Brief. *See generally* Appeal Brief. 37 C.F.R. § 41.37(c)(1)(vii) (2008).

Opinion

Claim Interpretation

The issues in this appeal entail the interpretation of the appealed claims. We give the claim terms the broadest reasonable interpretation consistent with the written description in the Specification. *See, e.g., In re*

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[3] We have not considered Yurasko (US 3,428,442) or Joseph (US 3,674,471) cited at page 20 of the Answer with respect to this ground of rejection since these references are not cited in the statement of the rejection at page 4 of the Answer.

[4] The Examiner has withdrawn the rejection of claims 35-42 and 44 over the Smirnov abstract in view of the Feng abstract, leaving claims 22 and 25 so rejected. Ans. 23.

Suitco Surface, Inc., No. 2009-1418, 2010 WL 1462294, at *3 (Fed. Cir. April 14, 2010) (quoting *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007) (citing *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004)).

Each of independent claims 1, 22, and 35 specifies a solid brazing component having a liquidus temperature above 840ºF which is in the form of a "wire, stripe, foil and performs," wherein the brazing component is made from "an alloy consisting essentially of" at least an amount of each of the recited elements phosphorous (P), tin (Sn), nickel (Ni), silver (Ag), silicon (Si), antimony (Sb), and manganese (Mn), as specified by the weight percent range for each element, with copper (Cu) stated as "the balance." Claim 35 additionally specifies that the sum of the weight percent of Sn and Sb does not exceed "about 10%," which limitation is also specified in claims 43 and 44, dependent on claims 1 and 22, respectively. Claims 5-7, dependent on claim 1, and claim 25, dependent on claim 22, do not have this limitation.

Independent claim 39 specifies "[a] fluxless solid brazing component . . . wherein the brazing component consists of" an amount of each of the recited elements P, Sn, Ni, Ag, Si, Sb, and Mn falling as specified by the weight percent ranges for each element, with Cu stated as "the balance," and wherein the sum of the weight percent of the elements Sn and Sb does not exceed "about 10%." We determine that the plain language of claim 39 specifies an "alloy" as the solid brazing component in light of the use of this term in the Specification that is limited to the specific elements in amounts falling within the specified weight percent ranges. *See generally* Spec.

Claim 39 also specifies that the sum of the weight percents of Sb and Sn in the alloy does not exceed "about 10%."

Claims 5, 36, and 40 further limit independent claims 1, 35, and 39, respectively, by specifying that the alloys encompassed therein must have "liquidus" and "solidus" temperatures falling within the stated "liquidus" and "solidus" temperature ranges, as these terms are defined in the Specification. *See* Spec., e.g., 6:19 to 7:7. Claims 6, 37, and 41 further limit claims 5, 35, and 39 on which they respectively depend by specifying different weight percent ranges for certain elements. Claims 7, 38, and 42 further limit claims 6, 37, and 41 on which they respectively depend by specifying that the alloys encompassed therein must exhibit a "major thermal arrest" at a temperature within the specified temperature range, as this term is defined in the Specification. *See* Spec., e.g., 7:1-7. In these respects, we note that independent claims 1, 22, 35, and 39 and dependent claims 25, 43, and 44 specify that the solid brazing component alloy must have a "liquidus" temperature above 840°F.

We cannot subscribe to Appellant's position that the preambular term "fluxless" and the claim drafting term "consists of" in claim 39 excludes association of the "solid brazing component" with a brazing flux. *See* App. Br., e.g., 5 and 25-27. This is because we fail to find the preambular term "fluxless" in the Specification of the present and the parent[5] Applications, or in a dictionary or encyclopedia, and the use of flux in association with the specified alloy is not precluded by the term "consists of." *See* App. Br. 5.

In the Amendment filed May 31, 2005 (Amendment), presenting

[5] Specification of Application 10/226,672 (parent Specification).

claim 39, Appellants state:

> Claims 39-42 are directed to fluxless solid brazing components of the forms recited that consist of the elements recited. . . . The phosphorus-copper brazing alloys of the present invention generally have the advantage of being capable of forming brazed joints between copper-based parts without the use of a flux . . . . The phosphorus content is such that the alloy is "self-fluxing" for the brazing of copper-based parts. . . . Thus, the present invention is directed to a solid brazing component as opposed to the powder/flux paste disclosed in the [Bziawa abstract] . . . With respect to claims 39-42, the "consists of" language precludes the presence of a flux.

Amendment 6-7. In the Amendment, Appellant did not point out support in the present and parent Specifications for the term "fluxless."

We find in the present and parent Specification the teaching of a "flux" separate from "a solid brazing component" alloy. *See* present Spec., e.g., 11:10; parent Spec., e.g., 19:4-8. Indeed, the term "flux" is used in the chemical arts to identify a substance which is used in brazing in addition to the solid brazing component to promote the fusing of metals, and the use of the term in the Specifications comports with the usage in the art.[6] The term "self-fluxing" also does not appear in the Specifications and is used in the art to describe a brazing alloy which does not require the use of a flux in brazing a particular metal.[7]

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[6] *See, e.g., Hawley's Condensed Chemical Dictionary* 508 (14th ed., Richard J. Lewis, Sr., revisor, John Wiley & Sons, Inc., 2001); *McGraw-Hill Dictionary of Scientific and Technical Terms* 783 (5th ed., Sybil P. Parker, ed., McGraw-Hill, Inc. 1994).

[7] *See* Second Henson Affidavit under 37 C.F.R. § 1.132 executed August 31, 2005, and filed September 6. 2005 (Second Affidavit), ¶ (5). *See also, e.g.*, J.F. Breedis and R.N. Caron, *Brazing, Wrought Copper and Wrought*

We thus interpret the preambular term "fluxless" in light of the language of claim 39 and the disclosure in the present and parent Specifications as it would have been understood by one of ordinary skill in the art to specify that the "solid brazing component" is "self-fluxing" to the extent that it can braze to any extent at least any metal in at least one brazing process without the aid of flux. To the extent the preambular term "fluxless" is intended by Appellant as a method or process of use limitation, the same has no effect as a claim limitation since the claimed "solid brazing component" is structurally identified in claim 39. *See, e.g., In re Paulsen,* 30 F.3d 1475, 1479 (Fed. Cir. 1994); *Rowe v. Dror,* 112 F.3d 473, 478 (Fed. Cir. 1997). Indeed, a method or process of use "limitation" that does not impose compositional or structural limitations has no place in a product claim. *Cf. In re Wiggins*, 397 F.2d 356, 359 n.4 (CCPA 1968), and cases cited therein. Furthermore, the claim drafting term "consists of" in claim 39 limits the claimed solid brazing component to the specified elements constituting an alloy and does not limit the association of a claimed alloy with any other material in any environment. *See, e.g., AFG Indus., Inc. v. Cardinal IG Co.*, 239 F.3d 1239, 1244-45 (Fed. Cir. 2001).

In the appealed claims, the weight percent ranges of the elements P, Sn, Ni, Ag, Si, Sb, and Mn and the liquidus, solidus, and major thermal arrest temperature ranges are prefaced with the term "about" or the language "up to about," which term and language are used in the Specification in these

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Copper Alloys, in 7 Kirk-Othmer Encyclopedia of Chemical Technology 453-54 (4th ed., John Wiley & Sons. 1996).

respects. *See generally* Spec. We find no disclosure in the Specification which specifies, by definition or otherwise, that the term "about" is other than a term of approximation. Thus, we determine that the term "about" allows the ranges to encompass weight percent amounts and temperatures which are beyond the stated upper and lower end points. *See* present Spec., e.g. 5:3-8, 10:22-24, 11:18-21, and 15:21 to 16:2. *See, e.g., In re Harris*, 409 F.3d 1339, 1343 (Fed. Cir. 2005) (citing *Jeneric/Pentron, Inc. v. Dillon Co.,* 205 F.3d 1377, 1381 (Fed. Cir. 2000) ("the '326 Application's use of the term 'about' shows that applicants did not intend to limit the claimed ranges to their exact end-points"). Our review of the disclosure of the Specification further reveals that the language "up to" does not specify a lower end point for a stated weight percent range, and thus is inclusive of "0.0" as the lower end point, signaling an "optional additional element." *See* Spec., e.g., 9:23 to 10:25. *See, e.g., In re Mochel*, 470 F.2d 638, 640 (CCPA 1972).

Thus, the simplest alloys, in terms of the number of elements in the alloy, falling within claim 1, within claim 22, within claims 35 and 39, and in claims dependent thereon, contain P, Sn, and Cu along with Ni and Ag (5 elements), Ni and Si (5 elements), or Si alone (4 elements), respectively, with the exception that the simplest alloy encompassed by claim 6, dependent on claim 1, must contain all 6 elements.

We cannot subscribe to Appellant's position that the claim drafting term "consisting essentially of" in claims 1, 22, and 35, and claims dependent thereon, excludes alloys that contain additional elements, such as zirconium (Zr), titanium (Ti), cerium (Ce), zinc (Zn), chromium (Cr), boron

(B), iron (Fe), carbon (C), and indium (In), included in alloys taught by the applied references. As the Examiner points out, Appellant's arguments do not establish that the written description in the Specification describes the additional elements and amounts thereof disclosed by the references as materially affecting the basic and novel characteristics of the claimed alloys. Ans. 17; *see generally* Briefs. *See, e.g., In re Herz*, 537 F.2d 549, 551-52 (CCPA 1976) ("[I]t is necessary and proper to determine whether [the] specification reasonably supports a construction" that would exclude or include particular ingredients.); *In re De Lajarte*, 337 F.2d 870, 873-74 (CCPA 1964); *see also PPG Indus., Inc. v. Guardian Indus. Corp.*, 156 F.3d 1351, 1354-57 (Fed. Cir. 1998). Indeed, the present Specification broadly describes a number of characteristics of "a solid phos-copper base brazing alloy component" as claimed, and discloses that such characteristics are affected by different amounts of the different elements that are disclosed and claimed. *See* present Spec., e.g., 4:17 to 5:3, 7:7 to 9:23, and 11:24 to 16:2.

The Rejections

We have considered the totality of the record in light of Appellant's arguments and the evidence in the record, including the four Affidavits by Robert Henson,[8] with respect to the appealed claims and the grounds of rejection advanced on Appeal. *See, e.g., In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("'On appeal to the Board, an applicant can overcome a

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[8] First Affidavit under 37 C.F.R. § 1.132 executed August 31, 2005, and filed September 6. 2005 (First Affidavit); Second Affidavit (*see above* note 5); Third Affidavit under 37 C.F.R. § 1.132 executed February 24, 2006, and filed March 6. 2006 (Third Affidavit); and Fourth Affidavit under

rejection by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.'") (quoting *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998)); *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) ("After evidence or argument is submitted by the applicant in response, patentability is determined on the totality of the record, by a preponderance of evidence with due consideration to persuasiveness of argument.") (citing, *inter alia*, *In re Spada*, 911 F.2d 705, 707 n.3 (Fed. Cir. 1990)).

Claims 1, 5-7, 22, 25, and 35-44: Bziawa and Feng abstracts

I

We find the Bziawa abstract would have described to one of ordinary skill in the art a 7 or 8 element Cu brazing alloy, in powder form, and the use thereof in the amount of "50-95" combined with "5-50 wt.%" of a carrier to form a brazing paste. The brazing paste "is esp. suitable for brazing of elec. motor terminals" and "permits brazing below 973 K[, that is, 1291.73°F,] to prevent embrittlement of the brazed contacts." In addition to Cu as "balance," the 7 element alloy must contain these six elements, in weight percent: 0.1-12 P; 0.1-25 Sn; 0.1-10 Ni; 0.0001-15 Ag; 0.01-0.5 Si; and 0.01-13 Sb. The Bziawa abstract also describes 8 element alloys which contain the element Zr in the amount of ". ltoreq. 0.05." As the Examiner finds, the Bziawa abstract does not describe Mn as an alloy element.

The Bziawa abstract describes the carrier as containing "Me cellulose

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37 C.F.R. § 1.132 executed July 19, 2006, and filed August 18, 2006, (Fourth Affidavit).

(I) 0.5-50, glucose . ltoreq. 15, starch . ltoreq. 20, and balance water." The Bziawa abstract describes "[a] typical paste [consisting] of 80 wt.% Cu alloy powder <400 .mu .m diam. and 20% carrier," wherein the 7 element Cu alloy contains, in weight percent, 0.1 P; 25 Sn; 0.1 Ni; 15 Ag; 0.5 Si; 0.1 Sb; and 59.1 Cu, and the carrier consists of, in weight percent: "I 2, glucose 18, and water 80."

We find the use of ". ltoreq." in the Bziawa abstract signifies an optional ingredient since the illustrative paste contains a 7 element alloy which does not contain Zr, and a carrier which does not contain starch. Thus, we find that in the described alloys of the Bziawa abstract, optional element Zr has weight percent range of 0.0-0.5%.

We find the Feng abstract would have described to one of ordinary skill in the art 8 element Cu containing "Ag-solder substitute" solder alloys having two types of compositions (in weight percent): low temperature solder alloys containing 3-10 P, 3-10 Sn, 0.5-15 Ni, 0.05-0.20 Si, 0.02-0.20 Zr, 0.02-0.20 Ti, 0.01-0.05 Ce, and balance Cu; and middle temperature solder alloys containing 0.02-0.20 P, 3-10 Sn, 0.5-15 Ni, 0.05-0.20 Si, 0.02-0.20 Zr, 0.02-0.20 Ti, 0.01-0.05 Ce, 20-45 Zn, and balance Cu. The Feng abstract describes the Ag free Cu solder alloys as used in the form of soldering rods, strips, and powders.

II

The Examiner finds that the Bziawa abstract discloses a "Cu alloy powder" product in which the elements of the Cu alloy are the same as those of the claimed solid brazing component alloys. Ans. 4 and 9; *see* Ans. 9, Table at col. "PL 319." The Examiner further finds that the Bziawa abstract

differs from the claims in not disclosing manganese as an alloy ingredient; the claimed liquidus, solidus, and thermal arrest temperatures; and a solid form of the alloy. Ans. 4. The Examiner determines that the claims read on "zero" manganese, and finds that the liquidus, solidus, and thermal arrest temperatures are a characteristic of, and thus inherently possessed by, an alloy, and points out that the claimed alloys "are overlapped" by the alloys of the Bziawa abstract. Ans. 5, 17, 18, and 20. The Examiner finds that the Feng abstract would have disclosed that a "brazing solder component" can be formed into rods, ingots, strips, powders and "conventional preforms." Ans. 5-6 and 16; *see also* Ans. 14 The Examiner concludes that one of ordinary skill in the art following the Feng abstract would have formed the Cu brazing alloy of the Bziawa abstract into a "form suitable for the brazing application such as a rod without paste and carrier." Ans. 5-6. The Examiner determines that the Bziawa abstract "teaches to add paste to lower the brazing temperature" and "it is contemplated within ambit of ordinary skill artisan to eliminate paste when lower brazing temperature is not needed." Ans. 6.

III

Appellant contends that the Examiner erred in relying on the Bziawa abstract which, according to Appellant, does not teach or suggest the claimed invention alone or in combination with the Feng abstract. Appellant argues that the manner in which the Bziawa abstract describes the alloys does not provide "a finite (and small in the context of the art)" number of alloy options from which one skilled in the art would have some reason to select particular alloys with the reasonable expectation of obtaining desired

properties. App. Br. 6-8, citing *KSR Int'l. Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1742 (2007); *Eisai Co. Ltd. v. Dr. Reddy's Laboratories, Ltd.*, 533 F.3d 1353, 1359 (Fed. Cir. 2008) (citing *KSR*, 550 U.S. at 420-21 (127 S.Ct. at 1742)); *Takeda Chem. Indus., Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350, 1356-357 (Fed. Cir. 2007). We cannot subscribe to Appellant's position.

The format used in the Bziawa abstract to describe a Cu alloy is the same format used by Appellant in the present and parent Specifications and the appealed claims to describe the claimed "alloy," and used for the same purposes in Yurasko, Joseph, and the Feng, Lugscheide and Smirnov abstracts. *See above* pp. 4-5. Thus, contrary to Appellant's position, the art-recognized format describes a finite set of alloys by specifying the element composition by weight percent ranges without requiring further modification for selection of an alloy or alloys therefrom. This use in the art has been consistently recognized in this respect by our reviewing court and one of its predecessor courts. Indeed, we know of no authority to the contrary and none has been cited by Appellant. *See, e.g., Harris*, 409 F.3d at 1341-44, and cases cited therein; *In re Peterson*, 315 F.3d 1325, 1329-30 (Fed. Cir. 2003), and cases cited therein ("The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages."); *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980); *Titanium Metals Corp. of Am. v. Banner*, 778 F.2d 775, 783 (Fed. Cir. 1985) ("proportions [of metal content in alloys] so close that prima facie one skilled in the art would have expected them to have the same

properties); *cf., e.g., Takeda Chem. Indus.*, 492 F.3d at 1356-357 (Fed. Cir. 2007) (quoting *In re Deuel,* 51 F.3d 1552, 1558 (Fed Cir. 1995) (The "test for prima facie obviousness for chemical compounds[, requiring 'a showing that the 'prior art would have suggested making the specific molecular modifications necessary to achieve the claimed invention,'] is consistent with the legal principles enunciated in *KSR*.").

In this respect, we find the weight percent ranges for the 7 elements of the Cu brazing alloys described in the Bziawa abstract encompass the weight percent ranges for P and Sn in claims 1 and 6, and for Ni in claim 6; overlap with the weight percent ranges for Ag, Sb, and Cu in claims 1 and 6, and for Si in claim 6; and fall within the weight percent ranges for Ni and Si encompassed by claim 1. Claims 1 and 6 encompass 7 element alloys that do not contain Mn which is not disclosed in the Bziawa abstract. Claims 1 and 6 do not exclude 8 element alloys that contain Zr disclosed as optional by the Bziawa abstract. The same relationships hold for claim 5, dependent on claim 1, and claim 7, dependent on claim 6, where the claimed alloys are further limited by the specified temperature ranges in these claims. In view of the weight percent ranges of Sn and Sb, the range of 7 elements Cu brazing alloys described in the Bziawa abstract overlap with the range of 7 element alloys encompassed by claim 43, dependent on claim 1.

With respect to claims 22 and 25, we find the weight percent ranges for the 7 elements of the Cu brazing alloys described in the Bziawa abstract encompass the weight percent ranges for P and Sn in claims 22 and 25, and for Ni in claim 25; overlap with the weight percent ranges for Sb and Cu in claims 22 and 25, and for Ag and Si in claim 6; and fall within the weight

percent ranges for Ni, Ag, and Si encompassed by claim 22. Claims 22 and 25 encompass 7 element alloys that do not contain Mn which is not disclosed in the Bziawa abstract. Claims 22 and 25 do not exclude 8 element alloys that contain Zr disclosed as optional by the Bziawa abstract. In view of the weight percent ranges of Sn and Sb, the range of 7 element alloys described in the Bziawa abstract overlap with the range of 7 element alloys encompassed by claim 44, dependent on claim 22.

With respect to claims 35 and 37, we find the weight percent ranges for the 7 elements of the Cu brazing alloys described in the Bziawa abstract encompass the weight percent ranges for P, Sn, and Ni in claims 35 and 37; overlap with the weight percent ranges for Sb and Cu in claims 35 and 37; and fall within the weight percent ranges for Ag and Si encompassed by claims 35 and 37. Claims 35 and 37 encompass 7 element alloys that do not contain Mn which is not disclosed in the Bziawa abstract. Claims 35 and 37 do not exclude 8 element alloys that contain Zr disclosed as optional by the Bziawa abstract. In view of the weight percent ranges of Sn and Sb, the range of 7 element alloys described in the Bziawa abstract overlap with the range of 7 element alloys encompassed by claims 35 and 37. The same relationships hold for claim 36, dependent on claim 35, and claim 38, dependent on claim 37, where the claimed 7 element alloys are further limited by the specified temperature ranges in these claims.

With respect to claims 39 and 41, we find the weight percent ranges for the 7 elements of the Cu brazing alloys described in the Bziawa abstract encompass the weight percent ranges for P, Sn, and Ni in claims 39 and 41; overlap with the weight percent ranges for Sb and Cu in claims 39 and 41,

and with Si in claim 41; and fall within the weight percent ranges for Ag encompassed by claims 39 and 41, and for Si by claim 39. Claims 39 and 41 encompass 7 element alloys that do not contain Mn which is not disclosed by the Bziawa abstract. Claims 39 and 41 exclude 8 element alloys that contain Zr disclosed as optional by the Bziawa abstract. In view of the weight percent ranges of Sn and Sb, the range of 7 element alloys described in the Bziawa abstract overlap with the range of 7 element alloys encompassed by claims 39 and 41. The same relationships hold for claim 40, dependent on claim 39, and claim 42, dependent on claim 41 where the claimed 7 element alloys are further limited by the specified temperature ranges in these claims.

Thus, in view of the encompassed and overlapped weight percent ranges for elements in common between the 7 element Cu alloys falling within the claims and within the Bziawa abstract, we determine that a considerable range of solid brazing component alloys are common to claims 1, 5-7, 22, 25, and 35-44 and the Bziawa abstract. *See, e.g., Harris*, 409 F.3d at 1341-44, and cases cited therein; *Peterson*, 315 F.3d at 1329-30, and cases cited therein; *Boesch*, 617 F.2d at 276; *Titanium Metals*, 778 F.2d at 783.

In reaching our determination, we are mindful of Appellant's position, with respect to the liquidus, solidus, and major thermal arrest temperatures ranges specified in claims 5, 7, 36, 38, 40, and 42, that the Examiner erred in finding that liquidus, solidus, and major thermal arrest temperatures are inherent in the alloys described in the Bziawa abstract which does not disclose the temperature characteristics of the alloys. App. Br., e.g., 17;

Reply Br., e.g., 7-8. We cannot subscribe to Appellant's position because we find that one of ordinary skill in this art would have considered the Cu brazing alloys described by the Bziawa abstract armed with the knowledge in the art that alloys of different composition, that is, the elements and the amounts thereof in an alloy, exhibit different temperature characteristics.

Indeed, Appellant acknowledges in the Specification that it was known in the prior art that the properties of "phos-copper" alloys and "silver-phos-copper" alloys, including temperature, ductility, and brazing characteristics, are affected by the presence and amounts of, and the absence of certain elements including, among others, P, Sn, Sb, Ni, Ag. Spec. 1-4. Appellant further acknowledges that the composition of an alloy, that is, the elements and the amounts thereof in the alloy, determines the liquidus temperature of that alloy, which "is a basic metallurgical concept." Reply Br. 6:7-9

Thus, we determine one of ordinary skill in the art would have selected 7 element Cu brazing alloys from those described by the Bziawa abstract which fall within a workable or optimum range of temperature characteristics for 7 element Cu alloys for brazing applications. *See, e.g., Boesch*, 617 F.2d at 276 ("discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.); *In re Aller*, 220 F.2d 454, 456 (CCPA 1955) ("[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.").

Accordingly, the burden shifted to Appellant to patentably distinguish the claimed solid brazing component alloys by argument and/or objective

evidence. *See, e.g., Harris*, 409 F.3d at 1343, and cases cited therein; *Peterson*, 315 F.3d at 1329-30, and cases cited therein.

V

Appellant submits that the Examiner erred in combining the Bziawa and Feng abstracts because the Feng abstract discloses a solder alloy and not a brazing alloy. App. Br. 16. Appellant argues that solder alloys are well known as more malleable than brazing alloys, and thus, "more easily formed into solid shapes," and the solder alloys and brazing alloys "have different elements and properties that affect the operating temperature and the formability of the alloys" and are classified differently in the field of metal-joining compositions. App. Br. 16. We disagree.

The difficulty we have with Appellant's position is that it does not account for the similarity of elements and amounts thereof constituting the 7 and 8 element Cu brazing alloys of the Bziawa abstract and the 8 element, Ag-free low temperature Cu solder alloys of the Feng abstract. We find the weight percent ranges of P, Sn, and Si in the low temperature Cu solder alloys are encompassed by the ranges for these elements in the Cu brazing alloys, and the weight percent range of Ni of the low temperature Cu solder alloys overlaps with that of the Cu brazing alloys. We further find that the weight percent range of optional Zr of the Cu brazing alloys overlaps with that of Zr of the low temperature Cu solder alloys. The low temperature Cu solder alloy contains, in weight percent, 0.02-0.20 Ti and 0.01-0.05 Ce while the Cu brazing alloys do not. We also find that the Cu brazing alloys contain at least 0.0001 weight percent Ag while the low temperature Cu solder alloys are Ag-free. *See above* pp. 10-11.

Thus, we determine that one of ordinary skill in this art would have reasonably expected the 7 element Cu brazing alloys of the Bziawa reference and the 8 element low temperature Cu solder alloys of the Feng abstract to have similar properties, including the formation of solid components for brazing and soldering, and Appellant has not adduced evidence or argument to the contrary. *See, e.g., Harris*, 409 F.3d at 1343-44, and cases cited therein; *Peterson*, 315 F.3d at 1330-31, and cases cited therein; *Boesch*, 617 F.2d at 276; *Titanium Metals*, 778 F.2d at 783.

Appellant contends "the additional elements in the solder alloy [in the Feng abstract] are precluded by the transitional phrase 'consisting essentially of' as recited in claim 1, . . . [because] additional elements can have a marked effect on the properties of the material, such as malleability/formability." App. Br. 16. Appellant further contends that the Feng abstract contains elements that exclude the Cu solder alloys from the scope of claim 39. App. Br. 27. With respect to claim 1, we find that while the low temperature Cu solder alloys of the Feng abstract do not contain at least about 0.1 Ag as required by claim 1, the weight percent ranges of P, Sn, Ni, and Si of the Cu solder alloys encompass, fall within, or overlap the ranges for the same elements in at least independent claims 1, 22, and 35, and claims 22 and 35 do not require Ag. On the present record, Appellant has not shown that these claims exclude alloys containing Zr, Ti, and Ce by reason of the claim phrase "consisting essentially of." *See above* pp. 8-9. Claim 39 excludes alloys containing Zr, Ti, and Ce by reason of the claim phrase "consisting of." *See above* p. 7. However, 7 element Cu brazing alloys of the Bziawa abstract fall within claim 39, and Appellant has also not

established that those alloys of the Bziawa abstract and the 8 element Cu solder alloys of the Feng abstract would not have similar properties with respect to forming solid components for brazing and soldering.

VI

Appellant submits that the Examiner erred in finding that the preponderance of the evidence in the First through Fourth Affidavits[9] and evidence in the present and parent Applications as presented in Table A[10, 11] does not weigh in favor of the patentability of claims 1, 5-7, 22, 25, and 35-44 over the combined Bziawa and Feng abstracts. Appellant has the burden of establishing by argument and/or evidence the practical significance of the asserted results alone and vis-à-vis the combined Bziawa and Feng abstracts, and why the results would have been considered unexpected in view of the applied prior art by one of ordinary skill in this art. *See, e.g., Harris*, 409 F.3d at 1343-44; *Peterson*, 315 F.3d at 1330-31; *In re Geisler*, 116 F.3d 1465, 1469-70 (Fed. Cir. 1997); *In re Merck & Co.*, 800 F.2d 1091, 1099 (Fed. Cir. 1986); *In re Longi*, 759 F.2d 887, 896-97 (Fed. Cir. 1985); *Boesch*, 617 F.2d at 276-77; *In re Lindner*, 457 F.2d 506, 508 (CCPA 1972); *In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972); *In re D'Ancicco*, 439 F.2d 1244, 1248 (1971). "In general, an applicant may

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[9] *See above* note 8.

[10] In the Evidence Appendix, Appellant states that the Third Affidavit includes Table A but we fail to find reference to such table therein. App Br. 12 and 43; *see generally* Third Aff. A copy of Table A was submitted with the Amendment filed March 6, 2006, which was entered in the Office Action mailed May 18, 2006, and the Third Affidavit was submitted with that Amendment. *See above* note 7.

[11] We append a copy of Table A to our decision.

overcome a *prima facie* case of obviousness by establishing 'that the [claimed] range is critical, generally by showing the claimed range achieves unexpected results relative to the prior art range," which "standard applies when . . . the applicant seeks to optimize certain variables by selecting narrow ranges from broader ranges disclosed in the prior art." *Peterson*, 315 F.3d at 1330-31, and cases cited therein. The claimed alloys must be compared to the closest prior art alloys and the showing of unexpected results must be commensurate in scope with the degree of protection sought by the claimed subject matter. *See, e.g., Harris*, 409 F.3d at 1344, *Peterson*, 315 F.3d at 1330-31, and cases cited therein; *Boesch*, 617 F.2d at 276-77, and cases cited therein.

VII

We find that the Tables on pages 1-2 of the First Affidavit describe the weight percent amounts of the elements of alloys A through K representing the claims and the Bziawa abstract compared in the First through Fourth Affidavits. First Aff. 1-2; Second Aff. 3-8 and Table 1; Third Aff. 1; Fourth Aff. 1-2. The same compositional information with respect to Alloys A-K is also listed in Table A which further includes Affiant Hensen's "Comments" with respect to the relationship between these alloys, the claims, and the Bziawa reference as reported in Table 1 of the Second Affidavit. Table A further sets forth the liquidus, solidus, and major thermal arrest temperature data reported in Table 1 for Alloys A-K, as well as such data for Alloys 4A-15A, corresponding to alloys 4-15 in the Table at page 14 of the present Specification, and Alloys 2B-17B, corresponding to alloys 2-17 in Tables 1 and 2 at pages 14 and 17 of the parent Specification.

We find that Table A does not contain data on the brazing characteristics of Alloys A-K, 4A-15A, and 2B-17B or the ability of these alloys to form a solid brazing component.

We initially determine whether the alloys in Table A fall within independent claims 1, 22, 35, and 39, as well as dependent claims 25, 43, and 44, and/or in the Bziawa abstract. We agree with the Examiner's finding that the 7 element Alloy F falls within independent claims 1 and 22 and within the 7 element alloys described by the Bziawa abstract; and that the 4 element Alloys I-K fall within claims 35 and 39 but fall outside of the Bziawa abstract. Ans., e.g., 10. *See above* p. 4-5 and 8. We further find that Alloy F also falls within claims 35, 39, 43, and 44 because the amount of Sn and Sb at 11 has not been shown to be outside the upper limit of "about" 10. We find that Alloy F is outside of claim 25 because of the amounts of Si and Ni. We find Alloys I-K do not include Ni, Ag, and Sb as do the 7 element alloys of the Bziawa abstract, which elements are among those known in the art to affect temperature, ductility, and brazing characteristics of Cu brazing alloys as acknowledged by Appellant in the Specification. *See above* p. 17.

With respect to the other 7 element Alloys A, B, C-1, D-1, E, G, and H-1, we find that 7 element Alloys A, B, and G fall outside claims 1, 22, 35, and 39 but are within the 7 element alloys described by the Bziawa abstract as set forth under "Comments" in Table A. However, contrary to the "Comments" in Table A, we further find that the 7 element Alloys C-1, D-1, E, and H-1 which are within the 7 element alloys of the Bziawa abstract also fall within at least two of claims 1, 22, 35, 39, 43 and 44: Alloy C-1 falls

within claims 1, 22, 35, 39, 43 and 44 because the amount of P at 3 has not been shown to be outside the claimed lower limit of "about" 4; Alloy D-1 falls within claims 1, 22, 43, and 44 because the amount of Sn at 11 is not shown to be outside the claimed upper limit of "about" 10 and the amount of Sn and Sb at 11.1 has not been shown to be outside the claimed upper limit of "about" 10; Alloy E falls within claims 1, 22, 35, 39, 43, and 44 because the amount of Sb at 5 has not been shown to be outside the claimed upper limit of "about" 4 and the amount of Sn and Sb at 11 has not been shown to be outside the claimed upper limit of "about" 10; and Alloy H-1 falls within claims 35 and 39 because the amount of P at 11 has not been shown to be outside the claimed upper limit of "about" 10. We find that Alloys A, B, C-1, D-1, E, G, and H-1 are outside of claim 25 because of the amounts of Si and Ni.

We further find that even if the 7 element alloys within the Bziawa abstract set forth in Table A fall just outside of the "about" limits of the weight percent ranges specified in the claims, these alloys are compositionally so close to the 7 element alloys falling just within the claimed "about" ranges that one of ordinary skill in this art would have reasonably expected the claimed 7 element alloys and reference 7 element alloys to have the same properties. *See, e.g. Titanium Metals*, 778 F.2d at 783.

We find that in the Fourth Affidavit, Affiant Hensen attests that 6 element Alloys C-2, D-2, and H-2 do not contain Ag and thus are outside of the Bziawa abstract, which is consistent with the "Comments" of "but no Ag" with respect to these alloys in Table A. Fourth Aff. 1; Second Aff. 1

and Table 1.

We find that the 4, 5, and 6 element Alloys 4A-15A and 2B-17B in Table A are also outside of the 7 element alloys described by the Bziawa abstract, but, except as noted, are within at least one of claims 1, 22, 25, 35, 39, 43, and 44: 6 element Alloys 4A, 6A-10A, and 10B-17B do not contain Sb; 6 element Alloy 9B does not contain Ni; 5 element Alloy 5A does not contain Si and Ag; 5 element Alloys 11A, 2B, 3B, 5B-8B do not contain Ag and Sb; 5 element Alloy 4B does not contain Ni and Ag; and 4 element Alloys 12A-15A do not contain Si, Ag, and Sb, and thus fall outside of the claims. Thus, unlike the 7 element alloys of the Bziawa abstract, the 4, 5, and 6 element Alloys 4A-15A and 2B-17B do not include at least one of Si, Ni, Ag, and Sb which elements are among those known in the art to affect temperature, ductility, and brazing characteristics of Cu brazing alloys as acknowledged by Appellant. *See above* p. 17.

VIII

Appellant contends that the evidence in the First Affidavit establishes that "the alloy paste" prepared "using alloys A-K in powder form mixed in a carrier as taught by the" Bziawa abstract "was inoperable regardless of which alloy composition was used," arguing that it is the "paste" and not the "alloy composition" that was addressed, and that the "failure of all attempts to form a brazed joint as [sic] a result of the Carrier." Reply Br. 2 (original emphasis deleted) and 5; *see* App. Br., e.g., 8-9. Appellant contends the evidence establishes that "a braze [did not] form at [a] temperature below or above 1292ºF, which is the temperature below which the [Bziawa abstract]

states its brazing paste may be used." Reply Br. 7. *See also* App. Br., e.g., 8.

Appellant contends that the evidence in the Second Affidavit establishes that Alloys A-K were cast "in billets, extruded into rod or wire form, i.e., a claimed solid brazing component, and then a braze was attempted." Reply Br. 2.

With respect to Alloy A, Appellant contends that in the First Affidavit, the only specific compositional example set forth in the Bziawa abstract, a paste of Alloy A and a particular carrier, was tested and "no braze could be formed," and adaptations made in an attempt to obtain a result "still could not obtain a commercially viable braze." App. Br. 9. "Attempts to braze . . . Alloy A[] of the [Bziawa abstract] without the Carrier, as set forth in the Second Affidavit, also failed produce a viable braze." Reply Br. 5. *See* Second. Aff. 3. Appellant contends, that in the Third Affidavit, "while [Alloy A] eventually melted, it did not flow and therefore, as asserted, did not form a braze at the temperature [1292°F] asserted by the [Bziawa abstract] or even at temperatures well above that." App. Br. 8. *See* Third Aff. 2-3. Appellant contends, that in the Third Affidavit, "[o]nly the addition of a commercial flux caused any flow of the brazing alloy [A] into the joint, but it is contrary to the teachings [of the Bziawa abstract] to use a commercial flux when a carrier is present." App. Br. 8-9.

With respect to Alloys B, C-1, and E, Appellant contends that in the First Affidavit, Alloys B and C-1, containing 1% and 3% P which are below the claimed range, and Alloy E, with 5% Sb which is above the claimed range, and 6% P which is within the claimed range, did not form "a

commercially viable braze." App. Br. 8-9. Appellant contends that pastes containing alloy powders within the Bziawa abstract "could not be used to form commercially viable brazes at brazing temperatures below [1292°F]." App. Br. 9.

Appellant further contends with respect to the Second Affidavit, that to show the criticality for the claimed range of 4-9% P, Alloys B and C-1, containing P below the claimed range, and Alloy H-1, containing P above the claimed range, were provided with all other components as claimed. App. Br. 13-14. Appellant contends that "[t]he claimed invention is specifically directed to alloys that can be classified as BCuP alloys by the American Welding Society" which requires "minimum phosphorous content and a maximum phosphorous content, neither of which is taught or suggested by the" Bziawa abstract. App. Br. 14. Appellant contends that "[a]t the claimed range of 4-9%, the brazing temperature profile is suitable for the intended purpose and the alloys can be formed into the recited solid components," whereas the tested Alloys B, C-1, and H-1, with P above and below the range were "unsuitable" and could not be formed into a claimed solid component. App. Br. 13-14, citing Second Aff. 3, 4, and 6.

With respect to Alloys D-1, E and F, Appellant contends that in the Second Affidavit, the criticality for the claimed Sn upper limit of 10% is shown by Alloy D-1, with 11% Sn and all other components as claimed, because the evidence establishes that it "'would not be practical to extrude this alloy on a commercial basis'" and this alloy is "'not a reliable braze material.'" App. Br. 14, quoting Second Aff. 4-5. The criticality of the claimed Sn + Sb upper limit of 10% and the claimed upper limit of Sb of 4%

is shown by Alloy E, with 5% Sb and 9% Sn + Sb, and Alloy F, with 3% Sb and 11% Sn + Sb, and all other components as claimed, because the evidence establishes that it "'would not be practical to extrude [Alloy E] on a commercial basis,'" and Alloy F "'could not be extruded," and that Alloys E and F are "'not a reliable braze material.'" App. Br. 14-15, quoting Second Aff. 5-6. "These tests demonstrate the criticality of the upper limits of Sn alone, Sb alone, and Sn combined with Sb for purposes of forming the claimed alloys into the claimed solid brazing components." App. Br. 15.

With respect to Alloy F, Appellant further contends that in the Second Affidavit, "Alloy F was considered a failure, due to the high combined content of Sn and Sb," and "Alloy F is provided as an example of the effect of too much Sn and Sb, combined, i.e., the alloy demonstrates the criticality of the proviso limitation." Reply Br. 4-5. *See* Second Aff. 6. *See also* App. Br., e.g., 10, citing Fourth Aff. 2; and App. Br. 12-13.

With respect to Alloy F, Appellant further contends that data in Table A "as well as additional testing data conducted post-filing" shows that of Alloys F, 4A-10A, and 10B-17B, "only . . . Alloy F[] was considered to be inoperable for producing a commercially viable braze . . . . [because] the combined Sn and Sb content exceeds 10%, which is taught in the specification to be a factor in achieving an operable solid brazing component," thus leading one of ordinary skill in the art "to exclude Alloy F from the scope of" claim 1. App. Br. 12-13. In this respect, Appellant contends, without reference to evidence, that "[t]he remaining 13 examples were all capable of being formed into the claimed solid components, and all demonstrated good temperature profiles for brazing, including a low solidus

temperature and small range between the solidus temperature and the major thermal arrest and/or liquidus temperature." App. Br. 13; *see also* App. Br. 19-20, 21-22.

With respect to Alloy G, Appellant contends, that in the Second Affidavit, criticality for the claimed P content of 9% (claims 1 and 22) and 10%, (claims 35 and 39), the claimed Sb content of 4% (claims 1, 22, 35, and 39), and the claimed Sn content of 8% (claims 35 and 39) and 10% (claims 1 and 22), is established by Alloy G which has 11% P "that just exceeded" that claimed, 5% Sb "that just exceeded" that claimed, 9% Sn "within" that claimed, and all other components as claimed. App. Br. 15. Alloy G was characterized as "'could not be extruded,'" having "'a very high liquidus and the solidus could not be identified,'" and braze tests could not be performed. App. Br. 15, quoting Second Aff. 6. *See also* Table A. "Thus, each of [P] content, Sn content, Sb content, and the total combined Sn and Sb content are critical for the claimed invention, to produce a BCuP alloy having [a] temperature profile that is suitable for brazing copper parts and for forming the alloy into a claimed solid brazing component." App. Br. 15.

Appellant contends that "[a]s set forth in the Second Affidavit . . . in addition to the importance of the brazing temperature, the composition must also be selected to provide a ductile alloy, one that is capable of being formed into a solid brazing component, and one that forms a braze that does not crack and fail in service," and can be extruded into wire or rod form, avoiding "hot shorts" and providing good "run speed." App. Br. 15-16.

With respect to Alloys I, J, and K, Appellant contends, that in the

Second Affidavit, "Alloy K is provided as an exemplary alloy of the invention of claims 35 and 39 that performs in a superior fashion to provide an excellent braze;" and "Alloys I and J . . . did not fail, but were not considered ideal." Reply Br. 2-4, citing Second Aff. 7-8. *See also* Second Aff. 6; App. Br., e.g., 10, citing Fourth Aff. 2; App. Br. 11 and 22-23. "The purpose of Alloys I and J was to test the alloy near the endpoints of the claimed ranges for P and Sn, without regard to the presence of Ag (which is required in Claim 1 but optional in claims 35 and 39) to show the criticality of the ranges for those two elements," and that "[t]he presence of lack of presence of Ag does not affect that criticality." App. Br. 11. *See also* Reply Br. 5 and 7. Appellant contends that Alloys I and J "did not fail, but were not ideal, the reason being that two of the components were at the end points of their ranges and that adjusting one or both of those components would result in improvement." Reply Br. 5. Appellant contends that Alloys I and J show that "adjustment of the [P] content to the middle of the range, i.e., 6-7%, increases the ductility . . . and prevents cracking of the braze, as well as creates a very narrow temperature range between the solidus and the liquidus (and/or major thermal arrest)." App. Br. 24; *see also* App. Br. 27-28.

Appellant further contends that the data in Table A shows that Alloys I and J and 2B-17B "were all capable of being formed into the claimed solid components, and all demonstrated good temperature profiles for brazing, including a low solidus temperature and small range between the solidus temperature and the major thermal arrest and/or liquidus temperature." App. Br. 22.

Appellant contents that "[i]n its totality, the evidence that has been provided serves to demonstrate the effect of varying certain elements relative to others," and "considered as a whole, rather than fixating on one or a few particular alloys, demonstrate criticality of the various narrow ranges claimed in claim 1, as well as in claims 22, 35 and 39." App. Br. 11. Appellant contends the "Examiner fails to appreciate that this is a multi-component alloy where elements act in synergistic relation," and Alloys "I and J show the effect of providing P near the lower limit with Sn at the upper limit, and vice-versa. . . . In other words, there is no single critical element. Each element has a critical range and all elements act together with synergy to produce a result that is either acceptable or unacceptable." Reply Br. 5.

IX

With respect to the "liquidus," "solidus," and "major thermal arrest" temperature range limitations specified in dependent claims 5, 7, 36, 38, 40, and 42 and the further element limitations specified in claims 6, 37, and 41, we noted above which of Alloys A-K, 4A-15A, and 2B-17B fall within the Bziawa abstract and claims 1, 35, and 39. *See above* pp. 5 and 22-24. Appellant contends that certain alloys fall within claims 5, 36, and 40, respectively, while others are excluded based on the liquidus and solidus temperature characteristics. App. Br. 17, 23-24, and 27. In view of the term "about," we disagree with Appellant's contention to some extent. This is because we determine that Alloys C-1 (liquidus: 1464ºF), 9A (liquidus: 1404ºF) and 11B (liquidus: 1458ºF) have not been shown to be outside the scope of claim 5, which specifies "a liquidus temperature less than about

1410ºF" and "a solidus temperature less than about 1100ºF;" and that Alloys D-1 (liquidus: 1305ºF), F (liquidus: 1352ºF), 3B (liquidus: 1344ºF), 5B (solidus: 1237ºF), and 9B (solidus: 1238ºF) have not been shown to be outside the scope of claim 36 and 40 each of which specifies "a liquidus temperature less than about 1300ºF" and "a solidus temperature less than about 1200ºF."

Appellant contends that certain of the alloys fall within claims 7, 38, and 42, respectively, while others are excluded based on the major thermal arrest temperature characteristic. App. Br. 18, 25, and 27-28. To the contrary, in view of the term "about," we find that Alloys 4A (1293ºF), 7A (1251ºF) and 8A (1296ºF) have not been shown to be outside the scope of claim 7, which specifies "a major thermal arrest at a temperature below *about* 1250ºF." We note that each of claims 38 and 42 specifies "major thermal arrest at a temperature below *about* 1275ºF."

Appellants contend that "[a]ll the alloys in Table 1 . . . and Table A . . . have a liquidus above 840°F, as claimed, but not all are suitable as a commercial brazing alloy as explained by" Affiant Hensen. "For example, certain alloys don't flow into the joint, others are too brittle and crack, others hot short, etc." Reply Br. 6-7. With respect to the temperature data in Table A, Appellant contends the evidence in various examples, both within and outside the claims shows "the affect of compositional variation on the temperature profile of the alloy," arguing that "[i]t cannot be presumed that the prior art inherently achieves the claimed temperature limitations, and the evidence shows that the temperature limitations are not necessarily achieved." App. Br. 17; *see also* App. Br. 18, 23-24, 27, and 28. With

respect to the difference in liquidus temperatures between Alloys F and I-K, Appellant contends, "[o]bviously, it is because they have different compositions. This is a basic metallurgical concept," explaining that while these alloys are within the scope of claims, "they are different and thus exhibit a different temperature profile, some of which fall within the narrow scope of claim 5 and some of which don't." Reply Br. 6.

Appellant contends that "5-8% Ni provides a balance between corrosion properties and extrudability" and Alloys "4A, 6A, 7A, and 8A demonstrate that the temperature profiles remain ideal as Ni content is varied from 5 to 6 to 7 to 8% respectively." App. Br. 18; *see also* App. Br. 20-21. Appellant contends that Alloys 9A-11A show that adjusting Ag and P provides "the alloy with a very tight, low temperature profile ideal for brazing at a low temperature." App. Br. 21. "As the ample evidence shows, not all alloys within the scope of the prior art or the scope of the claims exhibit major thermal arrests," establishing that a major thermal arrest is "not inherent across the broad compositional teachings of the prior art." App. Br. 25; *see also* App. Br. 28.

X

The Examiner finds that even if the First Affidavit "shows that the brazing paste for copper components cannot flow below 973K (1292ºF)," the claims do not include this limitation, but rather specify a liquidus temperature "above 840ºF". Ans. 10. The Examiner finds that the evidence in the First and Third Affidavits shows that Alloys F and I- K failed, and thus the Affidavits "clearly show that the claimed alloy compositions are not

better than prior art alloys (also failed the same tests) and there is no criticality of claimed compositions." Ans. 10. With respect to the "Comments" on Table 1 of the Second Affidavit that Alloy F has an "Sb + Sn > 10% - above claimed range," the Examiner finds that this limitation is not in claims 1 and 22, and that Alloys I-K which meet that limitation also "failed the tests." Ans. 10-11; *see also* Ans. 13, 13-14, 16, and 19. The Examiner finds that if "Mr. Henson in First Affidavit has shown that prior art alloys F (. . . claims 1 and 22) and I, J, K (. . . claims 35 and 39) are inoperable, then it is unclear why the instant claimed alloys would be operable." Ans. 11.

We determine that the Examiner uses the terms "operable" and "inoperable" to indicate whether a braze could and could not be formed under the conditions set forth in the Affidavits.

The Examiner finds that, contrary to the "Comments" in Table 1 of the Second Affidavit, Alloys I and J "failed to show ranges from end-point to end-point because appellant failed to keep other elements' contents constant and only to vary the content of critical element," and "there is no test done just outside the claimed end-points." Ans. 11; *see also* Ans. 13, 13-14, and 16. The Examiner contends that "[c]omparison must be done under identical condition expect for the novel features of the invention," and that the "showing of unexpected results must be . . . over the entire claimed range," and "[t]he scope of the showing must be commensurate with the scope of the claims." Ans. 11. The Examiner makes the same finding with respect to evidence pertaining to the liquidus temperature limitation in responding to Appellant's contentions with respect to Alloys B-E (App. Br.

10), pointing out that the liquidus temperature limitation of claim 5 "is a composition property," and thus, the showing of unexpected results must occur over the claimed range to be commensurate in scope with the claims. Ans. 12.

The Examiner also makes the same finding with respect to Appellant's argument with respect to evidence in Table A regarding Alloys F, 4A-10A, and 10B-17B, and Appellant's argument that Alloy F is the only "inoperable" alloy. Ans. 15; App. Br. 12. The Examiner further makes the same finding with respect to Alloys B, C-1, H-1, and I-J as failing to show "criticality" with respect to 4-9% P, pointing out that "if the alloys F, I, J, and K . . . are inoperable, it is no point to discuss compositions outside the claimed compositions." Ans. 15; *see also* Ans. 19. In this respect, the Examiner finds that since "none of those tests outside the claimed compositions has shown criticality of the instant claimed ranges because appellant failed to keep other elements' contents constant and only to vary the content of critical element," the tests were not done over the claimed range and thus, were not commensurate in scope with the claims. Ans. 15-16; *see also* Ans. 19. The Examiner finds with respect to Ni content that "there is no factual evidence showing the recited composition [of claim 6] is critical" and the "examples [pertaining to claim 25] fail to show criticality of claimed Ni content because" the compositions were not compared under identical conditions except for the novel feature which covered the claimed range. Ans. 17 and 18-19. The Examiner finds that "appellant has not shown the thermal arrest temperature is not inherently possessed by alloys of" the Bziawa abstract. Ans. 18.

XI

We are of the opinion that Appellant has not established that the Examiner erred in finding that a preponderance of the evidence in the Affidavits and Table A as argued by Appellant does not weight in favor of the patentability of claims 1, 5-7, 22, 25, and 35-44 over the combined Bziawa and Feng abstracts.

In considering the evidence in the Affidavits and Table A, we are mindful that, as we found above, one of ordinary skill in the art would have been armed with the knowledge that the properties of Cu alloys, including temperature, ductility, and brazing characteristics, are affected by the presence and amounts of P, Sn, Sb, Ni, and Ag among others. *See above* p. 17. This person would have further recognized that the elements and the amounts thereof in the alloy determine the temperature profile of that alloy, which, Appellant points out, "is a basic metallurgical concept." *See above* pp. 17 and 32. Thus, one of ordinary skill in the art would have determined the workable or optimum weight percent range of the elements in the 7 element alloys described by the Bziawa abstract, and indeed, the weight percent ranges for elements forming 7 element alloys in the claims "overlap" with the weight percent ranges for the same elements described by the Bziawa abstract, as the Examiner points out. This is the thrust of the Examiner's ground of rejection and Appellant thus can submit evidence of the criticality of the claimed weight percent ranges to address the issue of obviousness on this basis. *See above* pp. 16-18.

On this record, we agree with the Examiner's findings that the evidence in the First through Fourth Affidavits does not show a 7 element

alloy within the claims and the Bziawa abstract which will produce a braze under the test conditions employed, and does not include showings of the criticality of the claimed weight percent ranges of specific elements based on a comparison of a claimed 7 element alloy and at least one 7 element alloy within the Bziawa abstract which differs only in the amount of that element.

In the Affidavits, Appellant structured the tests and measured the results based on an unspecified "commercially viable" brazing and extrusion standard. As the Examiner points out, Alloy F, the only 7 element alloy tested that falls directly within claims 1 and 22 and within the Bziawa abstract, was reported to have failed. We disagree with Appellant's contentions that Alloy F does not fall within claims 1 and 22 on the basis that Sn + Sb is 11.0 because these claims contain no such limitation, as the Examiner points out. As the Examiner further points out, 4 element Alloys I and J, which fall within claims 35 and 39 but not within the Bziawa abstract, also failed, as indeed, it was reported that the braze obtained with each exhibited a crack under the bend test. We are not convinced otherwise by Appellant's contention that Alloys I and J did not fail because Appellant also contends that a commercially acceptable braze should not exhibit cracks. Apparently, Appellant's position is based on the notion that Alloys I and J did not fail because each could be readily modified to address such shortcomings. Such "modified" alloys were not identified and tested. *See above* p. 29. *See, e.g. Lindner*, 457 F.2d at 508 ("This court has said . . . that mere lawyers' arguments unsupported by factual evidence are insufficient to establish unexpected results." (citations omitted.)).

However, we cannot agree with the Examiner's finding that 4 element Alloy K, also falling within claims 35 and 39 but not within the Bziawa abstract, failed to form a braze. Indeed, as Appellant contends, Alloy K was reported to provide a commercially acceptable braze, an "exemplary embodiment."

The other 7 element alloys tested in the Affidavits were also reported to have failed under the tests in the Affidavits. This includes Alloys C-1, D-1, E, and H-1 which, along with Alloy F, have not been shown to be excluded from the claims in view of the claim term "about" used to define the element weight percent ranges and the alloy temperature characteristics. *See above* pp. 22-23 and 30-31. To the extent that the claims exclude these alloys, the same contain amounts of elements that are so close to the claimed weight percent ranges that one of ordinary skill in this art would have expected, on the present record, these alloys and the claimed alloys to have the same properties. *Titanium Metal*, 778 F.2d at 783. In any event, Alloy F is within claims 1 and 22. Thus, on this record, 7 element alloys within the claims failed.

We found above that Table A does not report the characteristics of Alloys 4A-15A and 2B-15B with respect to commercial braze and extrusion characteristics, and Appellant's contentions that the same would acceptably perform in these respects are unsupported by evidence adduced in the Briefs. *See above* pp. 22, 27-28, and 29-30. *See, e.g.*, App. Br. 43. *See, e.g. Lindner*, 457 F.2d at 508.

Appellant does not dispute the Examiner's position that the asserted evidence of criticality of claimed weight percent ranges with respect to the

claims and the Bziawa abstract is not based on a showing of unexpected results involving comparisons of alloys which differ only in the amount of the element sought to be established as critical. Indeed, we find no direct comparison of a claimed 7 element alloy with the closest prior art 7 element alloy within the Bziawa abstract in a manner that reflects the thrust of the rejection. *See, e.g., Harris*, 409 F.3d at 1342-44 (claimed alloy differed from prior art alloy in weight percent ranges of two elements); *Peterson*, 315 F.3d at 1330-31 ("applicant seeks to optimize certain variable by selecting narrow ranges from broader ranges disclosed in the prior art"); *In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991) ("[W]hen unexpected results are used as evidence of nonobviousness, the results must be shown to be unexpected compared with the closest prior art." (citation omitted)); *In re Burckel*, 592 F.2d 1175, 1179-80 (CCPA 1979) (the claimed subject matter must be compared with the closest prior art in a manner which addresses the thrust of the rejection); *In re Hoch*, 428 F.2d 1341, 1343-44 (CCPA 1970) (evidence must provide an actual comparison of the properties of the claimed invention with the disclosure of the reference)).

Furthermore, whatever comparison is provided between 7 element Alloys C-1, D-1, E, F, and H-1 and the 4 element Alloy K, the cause and effect sought to be demonstrated by the claimed weight percent ranges of the 4 elements of Alloy K is lost in the welter of unfixed variables in view of the different amounts of the 7 elements of the other alloys which additionally include elements Ni, Ag, and Sb, known to affect certain characteristics of the an alloy as we found above. *See, e.g., In re Heyna*, 360 F.2d 222, 228 (CCPA 1966) (compared claimed and prior art compounds structurally

differed by more than the single structural difference sought to be demonstrated) (quoting *In re Dunn*, 349 F.2d 433, 439 (CCPA 1965) ("[W]e do not feel it an unreasonable burden on appellants to require comparative examples relied on for nonobviousness to be truly comparative. The cause and effect sought to be proven is lost here in the welter of unfixed variables.")).

Appellant argues that the criticality of the end points of the claimed weight percent ranges, including the Sn and Sb limitation, are established by showings in the Affidavits based on one or more 7 element alloys which Appellant asserts are outside the claimed range, including Alloy F. Appellant further asserts that the failure of these alloys to acceptably perform in the commercial braze and extrusions tests shows that alloys that fall within the claimed weight percent ranges will acceptably perform under the same conditions. We cannot agree.

The indirect comparison of claimed and prior art compounds, including alloys, with respect to unexpected results is permissible. *See e.g., Boesch*, 617 F.2d at 276-77 (citing *In re Payne*, 606 F.2d 303, 316 (CCPA 1979), and cases cited therein) ("proof of unexpected properties may be in the form of direct or indirect comparative testing of the claimed compounds (here, alloys) and the closest prior art"); *In re Blondel*, 499 F.2d 1311, 1317 (CCPA 1974). However, in such case, Appellant must establish that the asserted indirect evidence demonstrates unexpected results for the claimed alloys. *See, e.g., Blondel*, 499 F.2d at 1317 ("Appellants' brief goes through a detailed, step-by-step analysis of the evidence in support of the conclusion to be drawn from the indirect comparison," establishing that the indirect

evidence provided a reliable indication of the performance of the closest claimed and prior art compounds). Here, Appellant has not carried that burden.

Indeed, the evidence as argued by Appellant establishes that the 7 element Alloys C-1, D-1, E, F, and H-1 all failed under the test conditions. All of these alloys fall either within the claimed weight percent ranges for 7 element alloys or are so close to the claimed ranges that they would have been expected to have the same properties as 7 element alloys within the claimed ranges at least at the end points. Thus, on this record, the evidence establishes that 7 element alloys within the claimed weight percent ranges do not exhibit unexpected results. Appellant has not established otherwise.

Accordingly, as the Examiner finds, the evidence in the Affidavits does not establish that the claimed 7 element alloys exhibit unexpected results vis-à-vis the 7 element alloys of Bziawa. Indeed, as Appellant contends, some alloys possess acceptable properties, some don't, and on this record, the tested 7 element alloys do not possess acceptable properties, at least under the test conditions. *See above* p. 30. As a result, Appellant has not adduced evidence establishing that 7 element alloys falling within and across the specified weight percent ranges of the elements in the claims in fact exhibit unexpected results under the test conditions in the Affidavits. *See, e.g., Peterson*, 315 F.3d at 1331("addition of rhenium in the lower portion of the claimed range did not produce unexpected results . . . and there are no data to show that the addition of rhenium in the uppermost portion of the claimed range . . . would lead to unexpected results"); *cf., e.g., Boesch*, 617 F.2d at 277 ("no evidence showing whether other alloys

encompassed by appellants' broad claims and having elements varying by relatively major amounts also exhibit a low creep rate").

We do not reach a different result with respect to the showings of temperature profiles of alloys with respect to the claimed liquidus, solidus, and thermal arrest temperature ranges reported in Table A. While Appellant argues that the Specification teaches one of ordinary skill in the art how to arrive at the alloys within the claimed temperature ranges, there are no limitations on elements and amounts thereof with respect to such alloys in claims 5, 7, 36, 38, 40, and 42. Indeed, Appellant acknowledges that certain elements and amounts thereof affect the temperature profile and the fact that some alloys exhibit the desired temperature profile and others don't is a matter of metallurgy. *See above* p. 32. Thus, the temperature profile of an alloy is a distinct characteristic of that alloy attributable to the elements and amounts thereof in the alloy. Therefore, on this record, Appellant has not established that the temperature profile of an alloy is an unexpected property of that alloy and would have been exhibited by all of the alloys in he claimed range of alloys which contained similar elements and amounts. In this respect, the discovery or elucidation of a previously unrecognized temperature property of 7 element alloys described by the Bziawa abstract does not render such alloys patentable simply because one of ordinary skill in the art following the Bziawa reference may not have appreciated the property. *See, e.g., Titanium Metals*, 778 F.2d at 782-83.

We considered the evidence in light of Appellant's arguments in the Briefs with respect to individual claims and groups of claims as reflected in our findings and discussions above. *See* App. Br. 17-28.

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Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of the Bziawa and Feng abstracts with Appellant's countervailing evidence of and argument for nonobviousness and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claims 1, 5-7, 22, 25, and 35-44 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

Claims 39-42: Bziawa abstract, Yurasko, and Joseph

We find that Joseph would have disclosed to one of ordinary skill in this art an alloy in powder or rod form for flame spray welding wherein the alloy can contain 6 elements, in weight percent: 3-7 P, 1-5 Sn, 0-2 Ni, 2-12 Ag, 0-0.5 Si, and balance Cu. Joseph col. 1, ll. 30-32, and col. 1, l. 55 to col. 2, l. 10.

The Examiner contends that Joseph's disclosure would have led one of ordinary skill in this art to use the 7 element Cu brazing alloys of Bziawa in solid or powder form without a carrier. Ans. 6-7 and 21, citing Joseph col. 1, ll. 30-32, and col. 1, l. 55 to col. 2, l. 10.

Appellant contends that the Examiner erred in combining the Bziawa abstract and Joseph because "furnace or torch brazing to form joints between parts is not the same as flame spraying to form a weld coating on a part," pointing out that in flame spray welding, alloys are "atomized and propelled onto the part," while the claimed alloys "are heated at the part surface to melt and flow into a joint." App. Br. 29. Appellant contends "[t]hat the

alloy of Joseph can be cast into a rod and fed as a raw material to a flame sprayer does not teach or suggest that the alloys of the [Bziawa abstract] can be formed into the claimed solid components for a brazing operation to form a joint between parts." App. Br. 29-30. We disagree.

We find no limitation in claim 39 which limits the claimed solid alloys, which can be in the form of a wire, to use in a method of "furnace or torch brazing." *See above* p. 7. Appellant further does not support the position with scientific reasoning or objective evidence establishing that one of ordinary skill in this art would not have reasonably expected the 7 element Cu braze alloys of the Bziawa reference and the 6 element alloys of Joseph to have similar properties, including the formation of solid components for brazing and welding. In this respect, we find the weight percent ranges of P, Sn, Ag, and Cu of the Joseph alloys are encompassed by the weight percent ranges for the same elements in the Bziawa abstract, while the weight percent ranges of Ni and Si overlap. *See above* pp. 10-11. The alloys of the Bziawa abstract contain at least 0.01 Sb while the Joseph alloys do not contain this ingredient and Appellant has not shown that this difference would have been expected to affect the formation of the alloys of the Bziawa abstract into a rod as taught by Joseph. *See, e.g., Harris*, 409 F.3d at 1343-44, and cases cited therein; *Peterson*, 315 F.3d at 1330-31, and cases cited therein; *Boesch*, 617 F.2d at 276; *Titanium Metals*, 778 F.2d at 783.

A discussion of Yurasko is not necessary to our decision.

We addressed above Appellant's contentions with respect to the evidence submitted in the Affidavits and Table A with respect to the

7 element Cu brazing alloys described in the Bziawa abstract. *See* App. Br. 29-31. Appellant does not explain how this evidence pertains to the 6 element Cu brazing alloys described in Joseph or Yurasko. App. Br. 29-31.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of the Bziawa abstract, Yurasko, and Joseph with Appellant's countervailing evidence of and argument for nonobviousness and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claims 39-42 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

<u>Claims 35-42: Lugscheide and Feng abstracts</u>

We find that the Lugscheide abstract would have described to one of ordinary skill in this art 6 element Cu brazing alloys containing, in weight percent, 4-8 P, 0-10 Sn, 0-18 Ag, 0-10 In, 0.01-0.08 Si, and 80-94 Cu, for brazing copper, wherein "the brazing alloy can be easily cold worked to shaped parts, while the flow and wetting properties are unaffected."

The Examiner contends the Lugscheide abstract discloses the features of the claims, including the claimed solid brazing components, but does not disclose the forms of the solid brazing component and the liquidus, solidus, and thermal arrest characteristics of the Cu brazing alloys. Ans. 7 and 21. The Examiner finds that one of ordinary skill in the art would have recognized from the Feng abstract that Ag free Cu solder alloys are used in the form of soldering rods, and strips, and thus, would have selected the solid form from those known in the art. Ans. 7-8 and 21. *See above*

p. 11. The Examiner further finds that the liquidus, solidus, and thermal arrest temperatures are a characteristic of, and thus inherently possessed by, an alloy, including those of the Lugscheide abstract. Ans. 7 and 21.

Appellant contends the Examiner erred in combining the Cu brazing alloys of the Lugscheide abstract and the Cu solder alloys of the Feng abstracts because "[t]here is simply no teaching or suggestion that a brazing alloy of [the Lugscheide abstract] can be formed into the specific claimed solid brazing components in view of a teaching that a solder alloy can be formed." App. Br. 31-32. "[T]he malleability/formability of the two distinct types of alloys are different as a result of differences in their compositions, which differences are prohibited by the 'consists essentially of' and 'consists of' language of claims 35-38 and 39-42, respectively." App. Br. 32. Appellant contends that the Lugscheide and Feng abstracts "each fail to identify Sb as a substitute for Sn, in whole or in part, and cannot then teach or suggest a limit on the content of the two elements in combination." App. Br. 32. We disagree.

The Lugscheide abstract discloses that the brazing Cu alloy can be "cold worked" which have described a solid brazing component to one of ordinary skill in this art that can be formed to fit any situation, that is, shaped into a preform for a particular application. As the Examiner points out, Appellant describes preforms in the Specification, and indeed, the claims specify "preforms" as a solid form. Ans. 21. The Examiner relies on the Feng abstract to show that it was known that in joining two metal parts, the solid solder alloy can also be in the form of rods, ingots, and strips. Ans. 7. *See above* p. 11. Indeed, as argued by the Examiner, the combined abstracts

establish that one of ordinary skill in the art of joining metal parts would have known the appropriate shapes, including shaping preforms, for solid brazing component alloys. Appellant's argument that the abstracts cannot be combined and applied to the claims because the difference between a "brazing" alloy and a "solder" alloy are precluded by the claim terms "consists essentially of" and "consists of" is without persuasive merit.

We are further unpersuaded by Appellant's contention that the abstracts do not disclose the relationship between Sb and Sn. Indeed, Sb is an optional element in claims 35-42, and thus, the combined abstracts apply even though neither describes a Sb-containing alloy.

We addressed above Appellant's contentions with respect to the evidence in the Affidavits and Table A including the liquidus, solidus, and thermal arrest temperatures. *See* App. Br. 32. Moreover, as the Examiner points out, Appellant does not explain how this evidence, directed to the 7 element Cu brazing alloys in the Bziawa abstract, pertains to the thrust of the ground of rejection based on the 6 element Cu brazing alloys described in the Lugscheide abstract. Ans. 23; App. Br. 32.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of the Lugscheide and Feng abstracts with Appellant's countervailing evidence of and argument for nonobviousness and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claims 35-42 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

<u>Claims 22 and 25: Smirnov and Feng abstracts</u>

<u>Claims 22, 25, 35-42, and 44: Yurasko and Feng abstract</u>

We find the Smirnov abstract would have described to one of ordinary skill in this art Cu brazing alloys containing, in weight percent, 5-10 P, 5-12 Sn, 8-15 Ni, 1.0-4.5 Si, 0.5-1.5 In, and balance Cu, which alloys decrease "[s]hrinkage porosity in the joints" and increase strength.

We find Yurasko would have described to one of ordinary skill in this art Cu welding alloys containing, in weight percent, 0-9 P, 0-10 Sn, 0-30 Ni, 1.0-3 Si, 0-1 Mn, and balance Cu, which are used "in various powder utilizing welding processes." Yurasko, e.g., col. 1, ll. 34-37, and col. 2, ll. 10-18.

The Examiner contends the Smirnov abstract and Yurasko disclose the features of the claims, including the claimed solid brazing components, but do not disclose the forms of the solid brazing component and the liquidus, solidus, and thermal arrest characteristics of the Cu brazing alloys. Ans. 7. The Examiner finds that the "claimed compositions are overlapped by alloys of Yurasko." Ans. 22. The Examiner finds that one of ordinary skill in the art would have recognized from the Feng abstract that Ag free Cu solder alloys are used in the form of soldering rods, ingots, strips or powder, and thus, would have selected the solid form from those known in the art. Ans. 7-8. *See above* p. 11. The Examiner further finds that the liquidus, solidus, and thermal arrest temperatures are a characteristic of, and thus inherently possessed by, an alloy, including those of the references. Ans. 7.

Appellant contends the Examiner erred in combining the Cu brazing alloys of the Smirnov abstract or the Cu welding alloys of Yurasko and the Cu solder alloys of the Feng abstracts. App. Br. 33-34. Appellant argues that the Cu brazing alloys described in the Smirnov abstract contain In, and

thus are excluded from claims 22 and 25 by reason of the claim language "consisting essentially of." App. Br. 33. Appellant further contends that in Yurasko, "each element of the [Cu] base alloys described therein is optional except" Cu, Yurasko does not "suggest that the compositions therein are suitable for use at brazing temperatures, i.e., . . . have a liquidus temperature above 840ºF as claimed," and thus, one of ordinary skill in the art would not have selected a particular combination of alloys from the reference. App. Br. 33-34; *see also* 34-35. Appellant contends that Yurasko does not teach Sb as a substitute for Sn, in whole or in part, and thus does not teach a limit on the content of the combination of the two elements as required by claims 35, 39, and 44. App. Br. 35. We disagree.

We determined above that claims 22 and 25 do not exclude alloys containing additional ingredients, such as In, by reason of the claim term "consisting essentially of," and thus, the In-containing Cu brazing alloys described by the Smirnov abstract are not excluded by the claims. *See above* 8-9. We further pointed out above that the format used by Yurasko and in the claims to describe alloys is recognized in the art to describe a finite set of alloys by specifying the element composition by weight percent ranges. *See above* pp. 13-14. Indeed, in both Yurasko and the claims the weight percent ranges of a number of elements are described as having a lower limit of '0" or "up to about" which achieves the same result. *See above* p. 8. Furthermore, Yurasko applies to the claims even though an Sb containing alloy is not described therein, for indeed, Sb is only an optional element in claims 22, 25, and 44. Thus, as the Examiner points out, the claimed element weight percent ranges and those described in Yurasko overlap, and

thus one of ordinary skill in this art following Yurasko would have prepared Cu welding alloys falling within the claims. In this respect, and contrary to Appellant's contention, one of ordinary skill in the art would have been guided to select alloys which would be useful in the welding processes taught in Yurasko, and Appellant has not established that alloys for such processes would have a liquidus temperature below 840°F.

We addressed above Appellant's contentions with respect to the evidence in the Affidavits and Table A including the liquidus, solidus, and thermal arrest temperatures. Appellant does not explain how this evidence, directed to the 7 element Cu brazing alloys in the Bziawa abstract, pertains to the thrust of the ground of rejection of claims based on the Cu welding alloys described in Yurasko. App. Br. 35-36.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of the Smirnov and Feng abstracts and of Yurasko and the Feng abstract with Appellant's countervailing evidence of and argument for nonobviousness and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claims 22, 25, 35-42, and 44 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

<u>Claims 22, 25, 35-38, and 44: Feng abstracts</u>

<u>Claims 1, 5, 22, and 43: Joseph</u>

The disclosures of the Feng abstract and Joseph are addressed above. *See above* pp. 11 and 42.

The Examiner contends the Feng abstract and Joseph each discloses the features of the claims, including the claimed solid brazing components and solid structures, but differ in not disclosing the liquidus, solidus, and thermal arrest temperatures, pointing out that these temperatures are characteristic of, and thus inherently possessed by, an alloy, including those of the references. Ans. 8.

With respect to the Feng abstract, Appellant contends the Examiner erred in applying this reference because, "by definition," the solder alloys of the Feng abstract would have a liquidus temperature below 840°F required by the claims, arguing that "[t]he liquidus temperature distinction between solders and brazing alloys is well established in the metallurgical art." App. Br. 36. "Appellant need not prove basic scientific principles that are known to those of ordinary skill in the art" because "[t]hese are not identical alloys, but rather, they are merely overlapping components." App. Br. 36. Appellant contends that the alloys of the Feng abstract include Zr, Ti, and Ce which are excluded by the claim language "consisting essentially of." App. Br. 36-37.

We found that the weight percent ranges of P, Sn, Ni, and Si of low temperature Cu solder alloys encompassed by the Feng abstract, fall within, or overlap the ranges for the same elements in at least claims 22, and 35, which claims do not require Ag and this element is not contained by the Feng abstract alloys, and that these claims do not exclude alloys containing Zr, Ti, and Ce by reason of the claim phrase "consisting essentially of." *See above* pp. 8-9, 11, and 19. We find that the terms "solder" and "low temperature" are not defined by the Feng abstract. *See above* p. 11. We

further determine that, as Appellant acknowledges, the temperature profile of an alloy is determined by its elements as a matter of metallurgy, and thus, one of ordinary skill in this art would have determined appropriate solder methods for using an alloy within the low temperature Cu solder alloys described in the Feng abstract to join metallic parts based on the solidus temperature of the alloy. *See above* pp. 16-17.

Accordingly, in view of the similarity in weight percent ranges between the elements of the claimed alloys and those of the Feng abstract, we determine that a considerable range of solid brazing component alloys are common to claims 22, 25, 35-38 and 44 and the Feng abstract. Thus, Appellant has the burden to patentably distinguish the claimed alloys over those described in the Feng abstract, and the mere argument that the term "solder" used to describe the alloys in the Feng abstract serves this purpose does not satisfy that burden. *See above* pp. 18-19. *See, e.g., Harris*, 409 F.3d at 1343, and cases cited therein; *Peterson*, 315 F.3d at 1330-31, and cases cited therein; *Boesch*, 617 F.2d at 276; *Titanium Metals*, 778 F.2d at 783; *see also, e.g., Geisler*, 116 F.3d at 1470 ("[I]t is well settled that unexpected results must be established by factual evidence.").

With respect to Joseph, Appellant contends the Examiner erred in applying this reference because Joseph's teaching to use an alloy described therein in cast rod form in flame spraying to "atomize the raw material and propel it onto a part surface to form a weld coating" is not "a teaching or suggestion of a solid brazing component of the claim forms" for use "between two parts to melt and flow into the joint by capillary action to bond the two parts together." App. 37-38. Appellant further contends that

Alloys 9B and 11B in Table A fall within Joseph's teachings but fall outside the temperature limitation of claim 5, establishing that it cannot be presumed that the alloys of Joseph have this limitation. App. Br. 38. Appellant contends Joseph does not teach the limitation with respect to combined Sn and Sb content specified in claim 43. App. Br. 38. We disagree.

We find the claimed weight percent ranges for P, Ni, and Cu and the for Sn, Ag, and Si respectively overlap and encompass the weight percent ranges for these elements in the alloys described by Joseph, and the claimed alloys can contain Sb while the Joseph alloys do not. *See above* p. 42. We find no limitation in claims 1, 5, 22, and 43 which limits the claimed solid alloys, which can be in the form of a wire, to use in a method of "brazing." *See above* p. 7. Thus, as the Examiner points out, Joseph teaches that the described alloys can be a solid rod, which satisfies the claimed solid form requirements. Ans. 23. Appellant has not established that the claimed alloys and the alloys described by Joseph have different properties. *See, e.g., Harris*, 409 F.3d at 1343, and cases cited therein; *Peterson*, 315 F.3d at 1330-31, and cases cited therein; *Boesch*, 617 F.2d at 276; *Titanium Metals*, 778 F.2d at 783.

We note in this respect that, contrary to Appellant's contention, Alloy 11B, which does not contain Sb and has a liquidus temperate of 1458°F, falls within claim 5 in view of the liquidus temperature range of "about 1410°F," and alloy 9B, which does not contain Ni, does not fall within the alloys described by Joseph which require Ni. *See above* pp. 30-31. In any event, we found above that the temperature profile of an alloy is a distinct characteristic of that alloy attributable to the elements and amounts thereof

in the alloy, and, on this record, Appellant has not established that the temperature profile of an alloy, including its liquidus temperature, is an unexpected property of that alloy and would have been exhibited by all of the alloys in the claimed range of alloys which contained similar elements and amounts. *See above* p. 41.

We are also unpersuaded by Appellant's contention that Joseph does not disclose the relationship between Sb and Sn, as indeed, Sb is an optional element in claims 1, 5, 22, and 43, and thus, Joseph applies even though the alloys do not contain Sb.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of the Feng abstract and of Joseph with Appellant's countervailing evidence of and argument for nonobviousness and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claims 22, 25, 35-38, and
44 and claims 1, 5, 22, and 43, respectively, would have been obvious as a matter of law under 35 U.S.C. § 103(a).

The Primary Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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TABLE A

Alloy	P	Sn	Si	Ni	Ag	Sb	Cu	Liquidus T	Major Thermal Arrest	Solidus T	Comments
A	0.1	25	0.5	0.1	15	0.1	Balance	1284	None	1040	Identical to example in Polish Abstract
B	1	6	0.5	0.1	15	0.1	Balance	1669	None	1045	Within Polish ranges; P content below claimed range
C-1	3	6	0.5	0.1	15	0.1	Balance	1464	1130	1046	Within Polish ranges; P content just below claimed range
C-2	3	6	0.5	0.1	0	0.1	Balance	1671	1225	1160	Within Polish ranges, but no Ag; P content just below claimed range
D-1	6	11	0.5	0.1	15	0.1	Balance	1305	1106	1046	Within Polish ranges; P within claimed range, but Sn just above claimed range
D-2	6	11	0.5	0.1	0	0.1	Balance	1293	1199	1177	Within Polish ranges, but no Ag; P within claimed range, but Sn just above claimed range
E	6	4	0.5	0.1	15	5	Balance	1215	None	1165	Within Polish ranges; High Sb content—above claimed range
F	6	8	0.5	0.1	15	3	Balance	1352	None	1091	Within Polish ranges; Sb + Sn > 10%—above claimed range
G	11	9	0.5	0.1	15	5	Balance	1584	None	??	Within Polish ranges; P, Sb, Sn+Sb above claimed range
H-1	11	6	0.5	0.1	15	0.1	Balance	1620	None	1069	Within Polish ranges; P above claimed range, Sn within range (opposite D-1)
H-2	11	6	0.5	0.1	0	0.1	Balance	1677	1164	1037	Within Polish ranges, but no Ag; P above claimed range, Sn within range (opposite D-2)
I	4	8	0.5	0	0	0	Balance	1467	1227	1179	Within claimed range: Near lower limit of P and upper limit for Sn for claimed range: Results for invention near endpoints
J	10	1	0.5	0	0	0	Balance	1503	None	1308	Within claimed range: Near upper limit of P, lower limit for Sn for claimed range: Results for invention near endpoints
K	6.7	6.65	0.15	0	0	0	Balance	1256	None	1179	Within claimed range: Exemplary embodiment

4A	5	6	0.02	5	15	0	Balance	1343	1293	1037	
5A	5	6	0	5	15	0	Balance	1352	1211	1037	
6A	5	6	0.02	6	15	0	Balance	1352	1205	1038	
7A	5	6	0.02	7	15	0	Balance	1353	1251	1034	
8A	5	6	0.02	8	15	0	Balance	1384	1296	1034	
9A	5	6	0.015	6	15	0	Balance	1404	1212	1056	
10A	7	6	0.015	6	6	0	Balance	1240	1114	1037	
11A	5	6	0.015	6	0	0	Balance	1134	None	1134	
12A	7.1	6	0	1	0	0	Balance	1241	None	1241	
13A	7.1	6	0	3	0	0	Balance	1264	1210	1098	
14A	7.1	6	0	5	0	0	Balance	1290	1178	1116	
15A	7.1	6	0	8	0	0	Balance	1359	1133	1098	
2B	6.7	2	0.02	2	0	0	Balance	1460	1253	1110	
3B	6.7	5	0.02	2	0	0	Balance	1344	1229	1102	
4B	6.75	2	0.1	0	0	1	Balance	1389	None	1285	

5B	6.7	6.6	0.02	1	0	0	Balance	1253	None	1237	
6B	6.7	6.6	0.02	1.4	0	0	Balance	1269	1239	1090	
7B	6.7	6.6	0.02	1.8	0	0	Balance	1279	1223	1093	
8B	6.7	6.6	0.02	2	0	0	Balance	1280	1215	1090	
9B	6.75	2	0.1	0	3	2	Balance	1296	None	1238	
10B	6.7	6.2	0.02	1.5	3	0	Balance	1226	1201	1033	
11B	7	2	0.02	2	2	0	Balance	1458	1246	1128	
13B	6	6	0.02	2	6	0	Balance	1288	1160	1060	
15B	5	6	0.02	2	15	0	Balance	1260	1127	1030	
16B	6	6.7	0.02	2	15	0	Balance	1107	None	1028	
17B	6	6	0.02	2	18	0	Balance	1118	None	1028	